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Cover: Plains leopard frog, *Rana blairi*, Union County, Illinois. Photographed in situ by Joshua J. Vossler. (For details see sighting number 4 in Table 1 of the note in this issue by Palis et al.)

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An Update and an Addition to the Anuran Fauna of LaRue-Pine Hills, Union County, Illinois

John G. Palis¹, Mary B. Boehler² and Joshua J. Vossler³

Abstract

The list of amphibians and reptiles inhabiting LaRue-Pine Hills, Shawnee National Forest, Union County, Illinois, has been generated by two faunal surveys of the area, one in the mid 1950s and the other in the late 1980s through early 1990s. The original herpetofauna list included 11 anurans; the follow-up survey added one more, bringing the total number of anuran species to 12. We recently detected a 13th anuran species, Plains Leopard Frog (*Rana blairi*), in LaRue-Pine Hills.

Introduction

LaRue-Pine Hills, Union County, Illinois, comprises wetland and river floodplain forest that borders cherty limestone bluffs and forested hills and valleys. Much of the area is included within the LaRue-Pine Hills/Otter Pond Research Natural Area, Shawnee National Forest. As a result of diverse topography, multiple natural plant communities, and its geographic location in the south-central Midwestern United States, the LaRue-Pine Hills/Otter Pond RNA is extremely biodiverse (Suloway et al., 1996).

Inventories of the amphibian and reptile fauna of LaRue-Pine Hills were first conducted during the 1950s (Rossman, 1960) and again during the late 1980s through the early 1990s (Ballard, 1994). Rossman (1960) generated a list of 11 anurans known from the area, including three species of ranids: Bullfrogs (*Rana catesbeiana*), Bronze Frogs (*Rana clamitans*), and Southern Leopard Frogs (*Rana sphenoccephala*). Rossman (1960) suggested that Pickerel Frogs (*Rana palustris*) and Wood Frogs (*Rana sylvatica*) might someday be detected at LaRue-Pine Hills. Rossman (1960) did not consider the possibility of Plains Leopard Frogs (*Rana blairi*) at LaRue-Pine Hills because the species was not described until more than a decade after his survey (Mecham et al., 1973).

In a follow-up inventory, Ballard (1994) detected the same 11 anuran species reported by Rossman (1960). He also mentioned a single Wood Frog observed in the area sometime between 1968 and 1971 by John S. Garton and Ronald A. Brandon, raising the anuran faunal list to 12 species. He suggested that Plains Leopard Frogs and Pickerel Frogs might occur at LaRue-Pine Hills.

Herein we add Plains Leopard Frogs to the list of anurans inhabiting LaRue-Pine Hills. We also report recent observations of Wood Frogs because they are so infrequently detected in the area.

Observations

Two Wood Frogs have been detected in the northern portion of LaRue-Pine Hills (i.e., in the vicinity of Snake Road; Palis, 2016) in recent years, the first by JJV at 1253 CT on 21 January 2017 (approximately 190 m south of the south end of Snake Road; Figure 1) and the second near a bluff by MBB at 1529 CT on 3 September 2018 (approximately 1 km north of the south end of Snake Road).

Our first probable sighting of a Plains Leopard Frog came at 2010 CT on 11 August 2019. We observed a leopard frog having a distinct spot on its snout on Snake Road, at approximately 37°33'27"N, 89°26'28"W. The frog leapt away before we could examine it closely. This observation intrigued us because Southern Leopard Frogs, ubiquitous at Snake Road, typically do not have a spot on the snout.

We observed an additional eight leopard frogs having a spot or two on the snout, between 1 and 9 September 2019, near Snake Road (Table 1; Figures 2 and 3). Close examination of these frogs revealed the following characteristics in common: 1 or 2 spots on the snout, a light spot in the center of each tympanum, white upper lip stripes, yellow pigment near the insertion of the hind limbs, and dorsolateral folds interrupted posteriorly and deflected medially. Plains Leopard Frogs are characterized by this combination of traits (Mecham, 1973). We shared an image of one of the frogs with Missouri Department of Conservation Herpetologist, Jeff Briggler, who concurred with our assessment that we had detected Plains Leopard Frogs in LaRue-Pine Hills.

Discussion

Recent observations of Wood Frogs and—especially—the detection of Plains Leopard Frogs at LaRue-Pine Hills demonstrate that despite our frequent visits to Snake Road and vicinity (e.g., Palis, 2018) there are still herpetofaunal discoveries to be



Figure 1. Wood Frog observed at LaRue-Pine Hills on 21 January 2017. Image by Joshua J. Vossler.

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Table 1. Date, time (Central Time), geocoordinates, and microhabitat of each Plains Leopard Frog sighting at LaRue-Pine Hills.

Sighting	Date	Time	Latitude	Longitude	Microhabitat
1	1-Sep-19	1411	37°33'18.1"	89°26'26.6"	on bluff, 0.4 m above ground
2	5-Sep-19	1343	37°33'17.6"	89°26'26.2"	on ground at base of bluff
3	5-Sep-19	1705	37°32'44.2"	89°26'21.5"	under log on talus slope
4	7-Sep-19	1557	37°33'18.4"	89°26'26.6"	on ground at base of bluff
5	9-Sep-19	1817	37°33'40.6"	89°26'27.6"	on ground within bluff hollow
6	9-Sep-19	2012	37°33'18.4"	89°26'27.5"	on ground at base of bluff
7	9-Sep-19	2021	37°33'16.7"	89°26'26.5"	on bluff, 1 m above ground
8	9-Sep-19	2023	37°33'16.5"	89°26'26.4"	on ground at base of bluff

made. We cannot say with certainty when Plains Leopard Frogs colonized LaRue-Pine Hills. We generally focus on snakes during our visits to the area so Plains Leopard Frogs may simply have been overlooked. It is also conceivable that we previously glanced at Plains Leopard Frogs at LaRue-Pine Hills, but incorrectly assumed that all spotted ranid frogs were Southern Leopard Frogs.

From where might LaRue-Pine Hills Plains Leopard Frogs have originated? Brown and Morris (1990) and Brown et al. (1993) provide locality data for Plains Leopard Frogs in Illinois. The nearest Union County record is Union County Conservation Area (Brown et al., 1993), approximately 13 km south-southeast of our southernmost Plains Leopard Frog sighting. The intervening area is used principally for row-crop agriculture. However, portions of the croplands are flooded annually for waterfowl hunting. These temporary wetlands, as well as flooded remnant stream channels and ditches that parallel roads and railroad

tracks, could have provided Plains Leopard Frogs with pathways for reaching LaRue-Pine Hills.

The nearest Plains Leopard Frog record plotted by Brown et al. (1993) is approximately 3 km west of LaRue-Pine Hills on the opposite side of the Big Muddy River in Jackson County. Plains Leopard Frogs colonizing LaRue-Pine Hills from that portion of Jackson County would have had to cross the Big Muddy River. Individuals, either as tadpoles or post-metamorphs, may have crossed the river of their own volition or been transported across the river during floods. The Mississippi River was at flood stage at Cape Girardeau, Missouri, from middle March through early August 2019. When the Mississippi River floods, it raises the Big Muddy River to flood stage. Such an extended period of flooding, which created rainwater and seep-water wetlands on the land sides of the levees, may have provided ample opportunity for anuran reproduction in 2019 and, perhaps, increased opportunities for dispersal.

Acknowledgments

Jeff Briggler kindly took the time to identify an image of a Plains Leopard Frog from LaRue-Pine Hills that we provided.



Figure 2. Plains Leopard Frog sighting 1, observed at LaRue-Pine Hills on 1 September 2019. Image by Joshua J. Vossler.



Figure 3. Plains Leopard Frog sighting 3, observed at LaRue-Pine Hills on 5 September 2019. Image by Joshua J. Vossler.

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Predation on an Adult American Bullfrog by an American Mink

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In its range in the United States and Canada, the American mink (*Neovison vison*) has a broad diet that can include frogs (e.g., Racey and Euler, 1983; Hoffman et al., 2009; Shier and Boyce, 2009). However, apparently not all populations of *N. vison* in North America consume frogs (Arnold and Fritzell, 1987, 1989; Wolff et al., 2015). In Europe, introduced *N. vison* consume frogs (Ward et al., 1986; Brzeziński, 2008; Sidorovich et al., 2010), leading to reduced frog populations (Ahola et al., 2006; Banks et al., 2008; Salo et al., 2010). However, much of the data on the diets of *N. vison* in North America comes from scat, or in other cases the food item is not identified beyond "frog" or "amphibian." The specific frogs consumed are thus not generally known. However, Turner (1960) speculated that *N. vison* is a predator on *Rana pretiosa*, and that *N. vison* consume *Rana* and *Hyla* frogs but these were not identified to species (Wilson, 1954).

Here we report an observation of *N. vison* preying upon an American Bullfrog, *Rana catesbeiana*. We deployed a camera trap (X-Change Color Model 1279, Cuddeback, DePere, WI) at a relatively newly created wetland (Spring 2015) at the Granville Schools Land Lab, a restored prairie/wetland complex in Licking County, Ohio (40.0889, -82.5408; datum: WGS84). On 21 March 2019, the camera trap photographed a *N. vison* carrying a relatively large frog in its mouth, suggesting a successful predation event (Figure 1). The size and coloration of the frog indicate it is an adult *R. catesbeiana* since they are the only frog in this area to reach that size (pers. obs., G. R. Smith). To our knowledge, this observation is only the second published record of predation on adult *R. catesbeiana* by *N. vison*. Sealander (1943) found *R. catesbeiana* in the winter diet of mink from southern Michigan. In addition, Korschgen (1958) suggested that frogs found in the winter diets of mink from Missouri possibly included *R. catesbeiana* but identification was not confirmed. In his review of the

biology of *R. catesbeiana*, Dodd (2013) indicates mink as a predator, but the reviews he cites that mention this (i.e., Bury and Whelan, 1984, and the studies they cite) indicate that tadpoles and juveniles of *R. catesbeiana* are consumed by mink but do not identify mink as a predator of adult *R. catesbeiana*. Our observation thus provides evidence for predation on adults of the widespread *R. catesbeiana* by a widespread generalist predatory mammal, *N. vison*.

Acknowledgments

We thank the U.S. Fish and Wildlife Service Partners for Fish and Wildlife Program for the loan of the camera trap. The creation of the Granville Schools Land Lab was supported by the U.S. Fish and Wildlife Service Partners for Fish and Wildlife Program and the Granville Exempted Village School District.



Figure 1. Photograph from a camera trap of an American mink (*Neovison vison*) preying upon an adult American Bullfrog (*Rana catesbeiana*) at the Granville Schools Land Lab, Licking County, Ohio, USA.

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Notes on the Herpetofauna of Nayarit, Mexico 3: Amphibians and Reptiles of the Municipality of Huajicori

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Abstract

From 2011 to 2019, we visited 11 localities within the municipality of Huajicori in the state of Nayarit, Mexico, adjacent to natural vegetation such as low tropical deciduous forest, oak forest, oak-pine forest, and pine forest. We have found 20 amphibian and 35 reptile species, for a total of 55 species, with 30 endemic to the country. Twenty of these species are categorized as protected in some way under the Norma Oficial Mexicana NOM-059-SEMARNAT-2010. By the IUCN two species are listed as vulnerable (VU), one as near threatened (NT), three with insufficient data (DD), and 12 reptile species are given no evaluation (NE). Thirty-five species are found to fall under the medium and high environmental vulnerability (EVS) categories. In addition, 22 of the amphibian and reptile species we found represent distribution extensions for the interior of the state. The sampling we carried out will increase the knowledge of the herpetological diversity in this area of Nayarit.

Resumen

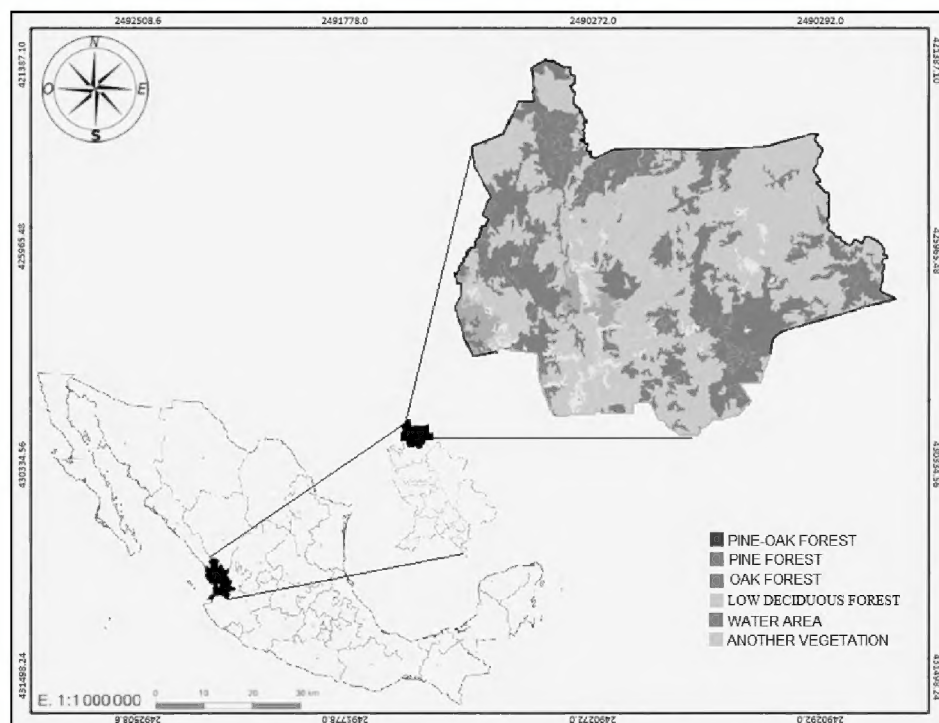
Del 2011 al 2019, se han realizado varios muestreos en 11 localidades del municipio de Huajicori en el estado de Nayarit, México, adyacentes a vegetaciones naturales como selva tropical caducifolia/selva baja caducifolia, bosque de encino, bosque de encino- pino y bosque de pino. Se han registrado un total de 20 anfibios y 35 reptiles en total 55 especies, con 30 endémicas al país. 20 de esas especies presentan categoría por NOM-059-SEMARNAT, dos especies presentaron categoría de vulnerabilidad (VU: siglas en inglés), una como casi amenaza (NT: siglas en inglés), tres en datos deficientes (DD: siglas en inglés) y 12 No evaluadas (NE: siglas en inglés) por la IUCN. 35 especie se reportan dentro de la categoría de mediana y alta de vulnerabilidad ambiental (EVS). Por otra parte, 22 especies de herpetofauna representan ampliaciones de distribución para el interior del estado. El muestreo realizado en el área incrementará el conocimiento herpetológico de la diversidad en esta zona para el estado.

Introduction and Background

Nayarit is one of the 10 smallest states of Mexico and covers an area of 26,979 km² (1.4% of the country) (<http://mr.travel by Mexico.com/966-estados-de-mexico-segun-su-superficie/>; accessed 27 September 2018). It is one of Mexico's western states, and there has been increasing interest in documenting its herpetological diversity. Nayarit herpetofauna represents about 12.4% of the amphibian and reptile species of Mexico, known as a country possessing great herpetological biodiversity (Flores-Villela and Garcia-Vazquez, 2014; Parra-Olea et al., 2014). The high level of diversity and endemism in the country is due to the

prodigious complexity of its geologic history, the climatic variety and its geographical position in the transition zone between the Nearctic and Neotropical (Sarukhán et al., 2009). In recent years, there has been a considerable increase in studies on the herpetological fauna in different regions of the state, and for the following specific municipalities: Sierra Vallejo, Bahía de Banderas and Compostela (Martínez and Ceballos, 2010; Loc-Barragan et al., 2013; Miramontes, 2017); Tepic (López-Solis and Lujá, 2014); Laguna Quelele and Bahía de Banderas (Fuentes-Castrejon and Maldonado-Gasca, 2015); Canal Centenario and Santiago Ixcuintla (Molina and Miramontes, 2016); Sierra San Juan, Xalisco, Tepic and San Blas (Lujá et al., 2017);

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Location of the municipality of Huajicori in the state of Nayarit, Mexico.

Yesca (Caravantes-Estrada et al., 2016); Tecuala (Loc-Barragán and Lazcano, 2018); Compostela (Loc-Barragán, Lazcano and Woolrich-Piña, 2018). However, some regions currently encompass inaccessible areas where the biodiversity remains unknown to the herpetological community, as is the case for most of the Sierra Madre Occidental. Furthermore anthropogenic activities are on the rise as consumption of natural resources accelerates (Woolrich-Piña et al., 2016). Documentation of the biodiversity of the area is essential as soon as possible. There must be a significant number of species inhabiting the foothills and higher elevations of these sierras. Knowledge of the existence of these species is important to recognize, so that we can implement conservation programs. Here we provide data for one more municipality of Nayarit, Huajicori, located to the northwest of the state and to the south of the foothills of the Sierra Madre Occidental and its high plateaus, plains and canyons.

Study Site (Biogeography)

The municipality of Huajicori lies in a mountainous northern region of Nayarit, between 22°32' and 23°06' N latitude and between 104°52' and 105°32' W longitude. Altitude varies from 100 to 2100 masl. Its area of 2,229.55 km² represents 9.43% of the total area of the state. It borders to the south with the municipality of Acaponeta; to the north and to the east with the state of Durango, in particular with the municipality of Mezquital and to the west with the state of Sinaloa, where its boundaries correspond to the municipality of Escuinapa and Rosario (<http://www.inafed.gob.mx/work/enciclopedia/EMM18nayarit/municipalidades/18005a.html>; accessed 27 September 2018). The municipality of Huajicori is represented by the following plant communities: Oak Forest; Oak-Pine Forest; Pine Forest; Low Tropical Deciduous Forest; Grassland. The oak, oak-pine and pine forests include species such as *Quercus magnoliifolia* (yellow oak / *encino naxis*), *Quercus prinopsis* (oak), *Pinus patula* (Mexican weeping pine / *pino llorón*), and represent around 56.07% of municipality's cover. The low tropical deciduous forests are composed of species like *Lysiloma divaricata* (horseflesh / *tepeguaje*), *Acacia cymbispina* (golden acacia / *cucharo*), *Plumeria rubra* (red paucipan / *cacalosúchil*), *Byrsonima crassifolia* (golden spoon / *nanche*), *Acacia pennatula* (fernleaf acacia / *tepame*) and represent the 36.86% of the municipality's cover. The

grasslands are dominated by three species, *Aristida* sp. (three-awn grass / *zacate de tres barbas*), *Bouteloua* sp. (gram grass / *navajita*), *Muhlenbergia* sp. (muhly / *zacatón*), and represent 5.43% of the municipality's cover. Other vegetation elements like *Orbignya cohune* (cohune palm / *coquito de aceite*), *Bursera* sp. (elephant Tree / *papelillo*) and *Sabal* sp. (palmettos / *palm*) represent 0.47% of the municipal cover (INEGI, 1999).

Field Work

From 2011 to 2019 we visited the following 11 localities in the municipality of Huajicori: La Estancia, Pachecos, Huajicori, El Muerto, Quiviquinta, Contadero, La Guasima, Santa María de Picachos, El Riito, Llano Grande and San Andrés Milpillás. All localities were adjacent to natural vegetation communities such as low tropical deciduous forests, oak forests, oak-pine forests, and pine forests. We implemented exhaustive sampling, day and night, searching in all areas for the presence of amphibians and reptiles. We covered the sample sites in random transects, looking in streams, under logs, under and on top of leaf litter, and under rocks. Upon finding a specimen we tried to photograph it in situ for identification or capture it momentarily to obtain a photograph. Records were made of the coordinates and the habitat. Specimens were released exactly where found.

Desk Work

We conducted a literature review and mined online database platforms (GBIF, 2018; EncicloVida, 2019) to establish a preliminary list of species that had previously been recorded in the study area, as well as basic information on the vegetation communities present. We then added to the preliminary list our field records from June 2011 to July of 2019. The ecological affinity of species was detailed in terms of the use of four vegetation communities. Species were identified as introduced or native, and whether or not endemic to Mexico. Conservation status was included, according to the Mexican Official Standard (SEMARNAT, 2010) and the IUCN Red List (IUCN, 2018). We evaluated the environmental vulnerability score (Wilson et al., 2013a; 2013b), so that species falling into categories such as insufficient data, not evaluated, and least concern according to IUCN could be assessed more accurately.

Results

We found the herpetological diversity of the municipality of Huajicori to be represented by 20 species of amphibians, grouped into two orders, nine families and 12 genera, and by 35 species of reptiles in two orders, 15 families and 29 genera. Thirty of these species of amphibians and reptiles are endemic to Mexico, 24 not endemic to Mexico and one introduced. Twenty-two records represent range extensions from their closest previously known localities. With respect to the status of conservation of found species, 20 amphibians and reptiles are protected by Mexican environmental law (SEMARNAT, 2010), 14 under "special protection" (Pr) and six "endangered" (A). According to the International Union for the Conservation of Nature (IUCN, 2018), 36 of the amphibian and reptile species occupy the "Least Concern" (LC) category, 12 are in the "Not Evaluated" (NE) category, three in the "Data Deficient" (DD)



Micrurus distans (UANL-8406), found in Pine Forest. Locality San Francisco del Caimán, Huajicori. Photograph by Emmanuel Miramontes.



Sceloporus nelsoni (UANL-8395), found in Low Deciduous Forest. Locality El Muerto, Huajicori. Photograph by Jesús Loc-Barragán.



Pine Forest, habitat of *Micrurus distans* (UANL-8406). Located on the Picachos-San Andres Milpilllas road, Huajicori. Photograph by Jesús Loc-Barragán.



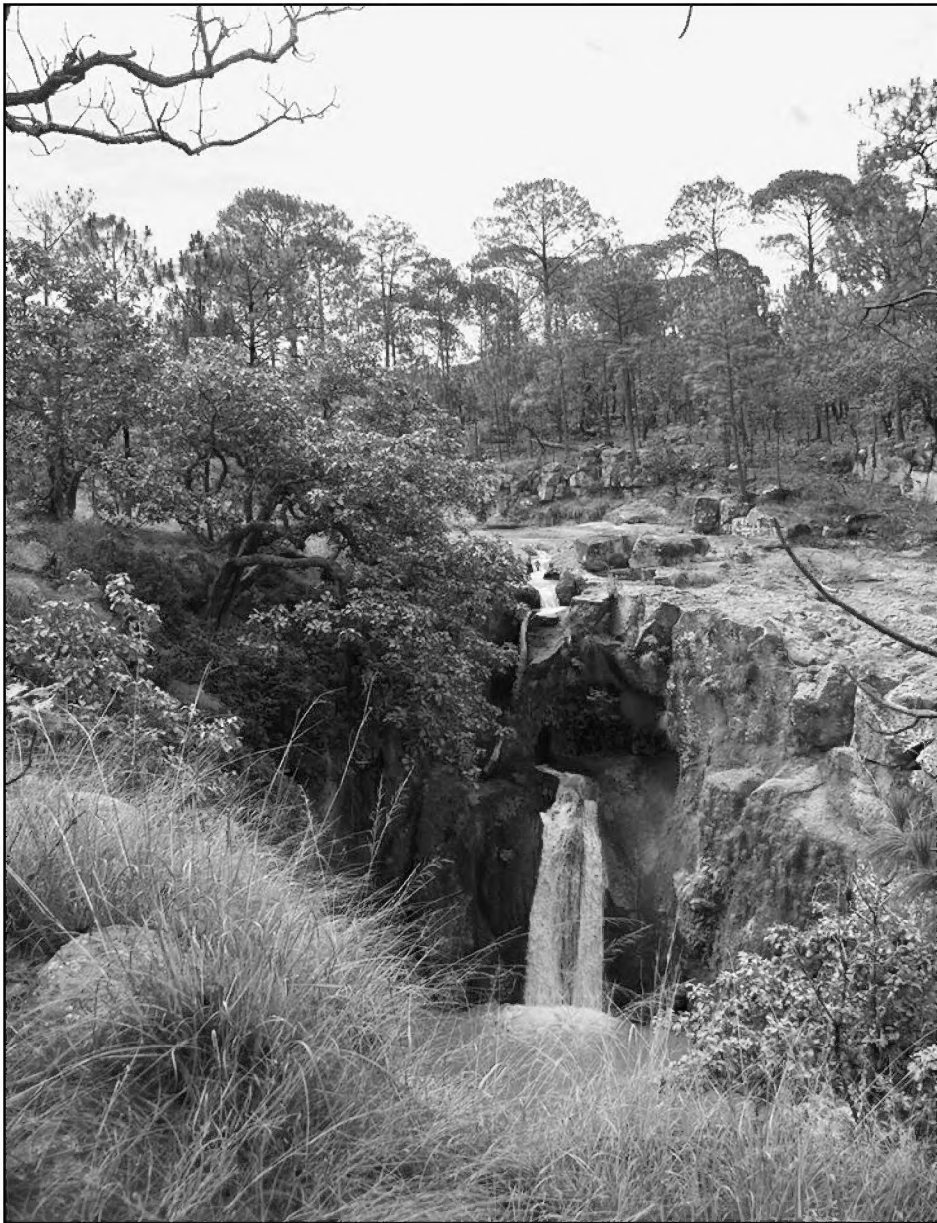
Mountainous plateau with Low Deciduous Forest and Oak Forest in the foothills of the Sierra Madre Occidental in Huajicori. Photograph by Jesús Loc-Barragán.



Leptodactylus melanonotus (UANL-8385), found in Low Deciduous Forest. Locality Huajicori, Huajicori, Photograph by Jesús Loc-Barragán.



Phyllodactylus lanei (UANL-8397) found in Low Deciduous Forest. Locality Contadero, Huajicori. Photograph by Jesús Loc-Barragán.



Pine and oak forest, habitat of *Ambystoma rosaceum*, located in Llano Grande, Huajicori. Photograph by Jesús Loc-Barragán.



Moment of capture by herpetologist Dr. Guillermo Woolrich of a *Masticophis mentovarius* in Low Deciduous Forest in Huajicori, Huajicori. Photograph by Jesús Loc-Barragán.

category, two in the “Vulnerable” (VU) category, and one in the “Near Threatened” (NT) category. Using the Environmental Vulnerability Score (EVS) proposed by Wilson et al. (2013a,b) to compare with these categories; 18 amphibians and reptiles fall into the category of low vulnerability, 19 in the middle category of vulnerability and 17 in the category of high vulnerability to environmental degradation (Table 1).

Discussion

Woolrich-Piña et al. (2016) reported the herpetofauna of Nayarit to comprise 154 species, 36 amphibians and 118 reptiles, of which 88 are endemic to Mexico. But that total did not include the record by Webb (1982) of Shannon’s Spiny Lizard (*Sceloporus shannonorum*) from Huajicori (see also Smith et al., 2006). That record brings the total to 155 species, 36 amphibians and 119 reptiles, of which 89 are Mexican endemics. Based on those numbers, our total of 30 endemics for Huajicori represents 34% of the endemic species reported for Nayarit and our total of 55 species of herpetofauna for Huajicori represents 36% of the amphibian and reptile richness of the state. The number of species found in this study and their levels of endemism are not insignificant, considering the relatively small area sampled. We managed to obtain more access to low tropical deciduous forests than to other plant communities, so we couldn’t conduct systematic samplings that would allow us to compare the number of species present in the different vegetation types. However, there do seem to be differences in species richness among these vegetation communities. We found 44 species of amphibians and reptiles in tropical deciduous forests, four in oak forests, three in pine-oak forests and five in pine forests. In addition, 22 records from the present study represent range extensions from the closest previously known localities (Table 1).

This report provides an additional contribution to the knowledge of the herpetofauna for the north of the state of Nayarit that will allow for improved application of conservation efforts. Increasing regional human activities, such as land conversion, hunting and illegal logging, constitute threats that will eventually affect biodiversity for this region. Thus, the senior author carries out environmental education programs and talks to local residents about how important it is that amphibian and reptile



Oak Forest habitat of *Norops nebulosus* (UANL-8388). Located on the Picachos-San Andres Milpilllas road, Huajicori. Photograph by Jesús Loc-Barragán.

diversity be conserved, especially the endemic species. The talks emphasize that many species are not dangerous. This could stop the slaughter of many harmless species due to false beliefs and lack of understanding of their role in the habitat. With an increase in scientific research we could enhance many of our efforts and produce a strong positive impact.

Conclusions

Previous literature records for the municipality of Huajicori consist only of a list of amphibians and reptiles found in the locality of Mineral del Tiger (Webb et al., 1981) and reports of presence for the region of Huajicori (Webb, 1982; Loc-Barragan and Carbajal-Marquez, 2016; Loc-Barragan and Ahumada-Carrillo, 2016; Loc-Barragan and Gonzalez-Olvera, 2017; Loc-Barragan, Quintero-Castañeda et al., 2018). Online database searches (GBIF, 2018; EncicloVida, 2019) of preserved collections found records of specimens from Huajicori that had not been published for 22 herpetofauna species. The summation of all this information makes a total of 56 species now known to be present in the municipality of Huajicori. We also include a comparison of the results of this study to the results published for other study sites or municipalities in the state (Table 2).

Reflection

Although there are seven natural protected areas in Nayarit (Parque Ecológico de Tepic; Marismas Nacionales; Islas Mariás; Isla Isabel; Islas Marietas; Sierra de Vallejo—Río Ameca; Sierra de San Juan), unprotected areas are at risk of losing their herpetofaunal diversity for reasons mentioned above. It is important to educate local communities in unprotected areas, explaining the function of herpetofaunal species in the different ecosystems. This is a vital effort needed to enhance the preservation and conservation of all unprotected areas, which not only benefits the species found in them, but also benefits the human population, since it has been documented that the presence of protected areas and green areas reduces the degree of stress on humans living in urban areas (Tyrväinen, 2014). Thus there is a rationale for protecting even more areas. We should strive for a greener and more biologically diverse world, where all have the commitment to participate in this process. We continue to be

amazed by how little humans choose to learn about the planet we occupy, thus continuing the exponential destruction.

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Table 1. Distributional and conservation status of the herpetofauna of the municipality of Huajicori, Nayarit, Mexico. Nomenclature follows Wilson et al. (2013a,b). An asterisk following the species name indicates a new record for the municipality. **END** = endemism: E = endemic to Mexico; N = not endemic to Mexico; I = Introduced. **NOM** = protection status under NOM-ECOL-059-2010 (SEMARNAT, 2010): P = En Peligro de Extinción (Endangered); A = Amenazada (threatened); Pr = Protección Especial (Special Protection); NS = No Status. **IUCN** = IUCN categorization: CR =Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near Threatened; LC = Least Concern; DD = Data Deficient; and NE = Not Evaluated. **EVS** = Environmental Vulnerability Score: low (L) vulnerability species (EVS of 3–9); medium (M) vulnerability species (EVS of 10–13); and high (H) vulnerability species (EVS of 14–20) (Wilson et al., 2013a,b; Woolrich-Piña et al., 2016). **Vegetation:** OF = Oak Forest; PF= Pine Forest; POF = Pine- Oak Forest; TDF =Tropical Deciduous Forest. Except for *Craugastor pygmaeus*, *Agalychnis dacnicolor* and *Masticophis mentovarius* the biogeographical affiliation of all species is to the Sierra Madre Occidental. See Appendix 2 for voucher specimens.

Taxon	END	NOM	IUCN	EVS	Vegetation	Locality and source
Bufonidae						
<i>Incilius marmoreus</i>	E	NS	LC	M(11)	TDF	6 mi E, Mineral del Tigre, Huajicori ²
<i>Incilius mazatlanensis</i>	E	NS	LC	M(12)	TDF	6 mi E, Mineral del Tigre, Huajicori ² Contadero, Huajicori ⁵
<i>Incilius occidentalis</i>	E	NS	LC	M(11)	OF/POF/PF	El Magney, 2.5 days E by mule from Huajicori ¹
<i>Rhinella horribilis</i>	N	NS	LC	L(3)	TDF	6 mi E, Mineral del Tigre, Huajicori ²
Craugastoridae						
<i>Craugastor augusti</i>	N	NS	LC	L(8)	TDF	6 mi E, Mineral del Tigre, Huajicori ²
<i>Craugastor occidentalis</i>	E	NS	DD	M(13)	TDF	6 mi E, Mineral del Tigre, Huajicori ²
<i>Craugastor pygmaeus</i>	N	NS	VU	L(9)	TDF	El Muerto, Huajicori ⁴
<i>Craugastor vocalis</i>	E	NS	LC	M(13)	?	Las Guásimas, 5 mi SE of Huajicori El Riito, ca. 4.3 mi S and 12 mi E of Huajicori ¹
Eleutherodactylidae						
<i>Eleutherodactylus pallidus</i> *	E	PR	DD	H(17)	TDF	2.7 mi SW Huajicori on paved road Acaponeta-Huajicori ⁵
Hylidae						
<i>Dryophytes arenicolor</i> *	N	NS	LC	L(7)	TDF	Barbacoa, Huajicori ⁵
<i>Smilisca baudinii</i>	N	NS	LC	L(3)	TDF	6 mi E, Mineral del Tigre, Huajicori ² Contadero, Huajicori ⁵
<i>Smilisca fodiens</i>	N	NS	LC	L(8)	TDF	2.8 mi E Huajicori on paved road Huajicori-Picachos ⁵
<i>Tlalocohyla smithii</i>	E	NS	LC	M(11)	TDF	3 mi SE of Huajicori ¹ 2.8 mi E Huajicori on paved road Huajicori-Picachos ⁵
Phyllomedusidae						
<i>Agalychnis dacnicolor</i> *	E	NS	LC	M(13)	TDF	Contadero, Huajicori ⁵
Leptodactylidae						
<i>Leptodactylus melanonotus</i>	N	NS	LC	L(6)	TDF	1 km S of Huajicori, Río Acaponeta ¹ Huajicori, Río Acaponeta ⁵ 2.8 mi E Huajicori on paved road Huajicori-Picachos ⁵
Microhylidae						
<i>Hypopachus variolosus</i> *	N	NS	LC	L(4)	TDF	2.7 mi SW Huajicori on paved road Acaponeta-Huajicori ⁵
Ranidae						
<i>Lithobates forreri</i>	N	PR	LC	L(3)	TDF	1 km S of Huajicori, Río Acaponeta ¹ Contadero, Huajicori ⁵ 2.8 mi E Huajicori on paved road Huajicori-Picachos ⁵
<i>Lithobates magnaocularis</i> *	E	NS	LC	M(12)	TDF	Barbacoa, Huajicori ⁵
<i>Lithobates pustulosus</i>	E	PR	LC	L(9)	TDF	5 mi E Poblado de Huajicori ¹ 6 mi E, Mineral del Tigre, Huajicori ^{1,2}
Ambystomatidae						
<i>Ambystoma rosaceum</i> *	E	PR	LC	H(14)	POF	Llano Grande, Huajicori ⁵
Dactyloidae						

Table 1. (cont'd)

Taxon	END	NOM	IUCN	EVS	Vegetation	Locality and source
<i>Norops nebulosus</i>	E	NS	LC	M(13)	LDF/OF/PF	6 mi E, Mineral del Tigre, Huajicori ^{1,2} Huajicori, Huajicori ⁵ Road Picachos-San Andrés Milpillas ⁵ San Andrés Milpillas, Huajicori ⁵ El Muerto, Huajicori ⁵
Gekkonidae						
<i>Hemidactylus frenatus</i> *	I	-	-	-	TDF	Huajicori, Huajicori ⁵
Helodermatidae						
<i>Heloderma horridum</i>	N	A	LC	H(14)	TDF	6 mi E, Mineral del Tigre, Huajicori ^{1,2}
Iguanidae						
<i>Ctenosaura pectinata</i>	E	A	NE	H(15)	TDF	13 mi N of Acaponeta ¹ 6 mi E, Mineral del Tigre, Huajicori ² Huajicori, Huajicori ⁵
Phrynosomatidae						
<i>Sceloporus albiventris</i> *	N	NS	NE	H(16)	TDF	Road Quiviquinta-Contadero ⁵
<i>Sceloporus clarkii</i> *	N	NS	LC	M(10)	TDF	Huajicori, Huajicori ⁵ Quiviquinta, Huajicori ⁵
<i>Sceloporus shannonorum</i>	E	NS	NE	H(15)	?	0.6 mi S and 16.7 mi E of Huajicori ³
<i>Sceloporus nelsoni</i>	E	NS	LC	M(13)	TDF	6 mi E, Mineral del Tigre, Huajicori ^{1,2} El Riito, ca. 4.3 mi S and 12 mi E of Huajicori ¹ El Muerto, Huajicori ⁵ Barbacoa, Huajicori ⁵ 2.8 mi E Huajicori on paved road Huajicori-Picachos ⁵
<i>Sceloporus utiformis</i>	E	NS	LC	H(15)	TDF	Quiviquinta, Huajicori ¹ 6 mi E, Mineral del Tigre, Huajicori ¹
<i>Urosaurus bicarinatus</i>	E	NS	LC	M(12)	TDF	1 km S of Huajicori, Río Acaponeta ¹ Contadero, Huajicori ⁵
Phyllodactylidae						
<i>Phyllodactylus lanei</i>	E	NS	LC	H(15)	TDF	0.6 mi S of Huajicori, Río Acaponeta ¹ Contadero, Huajicori ⁵
<i>Phyllodactylus tuberculosus</i>	N	NS	NE	L(8)	TDF	6 mi E, Mineral del Tigre, Huajicori ^{1,2}
Teiidae						
<i>Aspidoscelis costata</i>	E	PR	LC	M(11)	TDF/OF	1 km S of Huajicori, Río Acaponeta ¹ 6 mi E, Mineral del Tigre, Huajicori ^{1,2} Huajicori, Huajicori ⁵ Contadero, Huajicori ⁵ El Riito, ca. 4.3 mi S and 12 mi E of Huajicori ⁵ 2.8 mi E Huajicori on paved road Huajicori-Picachos ⁵
Boidae						
<i>Boa sigma</i> *	E	NS	NE	H(15)	TDF	Huajicori, Huajicori ⁵
Colubridae						
<i>Drymobius margaritiferus</i>	N	NS	NE	L(6)	TDF	6 mi E, Mineral del Tigre, Huajicori ²
<i>Lampropeltis polyzona</i> *	E	NS	NE	M(11)	TDF	1 mi S of Huajicori on paved road Acaponeta-Huajicori ⁵
<i>Leptophis diplotropis</i> *	E	A	LC	H(14)	TDF	Huajicori, Huajicori ⁵
<i>Masticophis mentovarius</i> *	N	A	NE	L(6)	TDF	3 mi S of Huajicori on paved road Acaponeta-Huajicori ⁵
<i>Mastigodryas melanolomus</i>	N	NS	LC	L(6)	TDF	6 mi E, Mineral del Tigre, Huajicori ^{1,2}
<i>Oxybelis aeneus</i> *	N	NS	NE	L(5)	TDF	1 mi S of Huajicori on paved road Acaponeta-Huajicori ⁵
<i>Pituophis deppei</i>	E	A	LC	H(14)	POF	Santa María de Picachos ⁶
<i>Pseudoficimia frontalis</i> *	E	NS	LC	M(13)	TDF	El Riito, ca. 4.3 mi S and 12 mi E of Huajicori ⁵
<i>Tantilla yaquia</i> *	N	NS	LC	M(10)	OF	El Riito, ca. 4.3 mi S and 12 mi E of Huajicori ⁵
<i>Trimorphodon paucimaculatus</i> *	E	NS	NE	H(15)	OF	3 mi S of Huajicori on paved road Acaponeta-Huajicori ⁵
Dipsadidae						
<i>Imantodes gemmistratus</i>	N	PR	NE	L(6)	TDF	El Muerto (Los Vergelitos) ⁷

Table 1. (cont'd)

Taxon	END	NOM	IUCN	EVS	Vegetation	Locality and source
<i>Leptodeira maculata</i>	N	PR	LC	L(7)	TDF	6 mi E, Mineral del Tigre, Huajicori ² Contadero, Huajicori ⁵
Elapidae						
<i>Micrurus distans</i> *	N	PR	LC	H(14)	PF	San Francisco del Caimán ⁵
Natricidae						
<i>Storeria storerioides</i>	E	NS	LC	M(11)	PF	Near Cueva de Las Guacamayas, ca 10 km E of Lagunitas ¹ Road Picachos-San Andrés Milpillás ⁵
Viperidae						
<i>Agkistrodon bilineatus</i> *	N	PR	NT	M(11)	TDF	Huajicori, Huajicori ⁵
<i>Crotalus basiliscus</i> *	E	PR	LC	H(16)	TDF	San Andrés Milpillás, Huajicori ⁵
<i>Crotalus lepidus</i>		PR	LC	M(12)	PF	El Maguey, Huajicori ¹
Emydidae						
<i>Terrapene nelsoni</i>	E	PR	DD	H(18)	TDF	Huajicori, Huajicori ⁸
<i>Trachemys ornata</i> *	E	PR	VU	H(19)	TDF	3 mi S of Huajicori on paved road Acaponeta-Huajicori ⁵
<i>Rhinoclemmys pulcherrima</i>	N	A	NE	L(8)	TDF	6 mi E, Mineral del Tigre, Huajicori ²
Kinosternidae						
<i>Kinosternon integrum</i> *	E	PR	LC	M(11)	TDF	Huajicori (Río Acaponeta) ⁵

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Table 2. Composition of the herpetofauna reported for each of six Nayarit municipalities. **Vegetation communities:** LTS = Low Thorny Scrub, LDF = Tropical Deciduous Forest, MDF = Medium Deciduous Forest, OF = Oak Forest, POF = Pine Oak Forest, CF = Cloud Forest, RV = Riparian Vegetation, CD = Coastal Dunes, M = Mangrove, HV = Halophyte Vegetation, PG = Palm Grove.

Municipality	Number of herpetofauna species for each vegetation community												Number of species of herpetofauna reported	
	LTS	TDF	MDF	OF	POF	PF	CF	RV	CD	M	HV	PG	Amphibians	Reptiles
Tepic ¹	–	–	–	–	–	–	–	–	–	–	–	–	14	19
Bahia de Banderas ²	6	–	18	–	–	–	–	–	–	19	–	–	5	29
Santiago ³	18	12	19	–	–	–	–	14	–	–	–	–	10	23
Tecuala ⁴	30	25	–	–	–	–	–	16	12	9	7	–	17	34
Compostela ⁵	–	46	37	13	–	–	9	–	9	6	–	8	21	50
Huajicori ⁶	–	44	–	2	2	4	–	–	–	–	–	–	20	35

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Appendix 1: Statement of Contribution of Authors

JALB, ZISH, CIG, EMM, JABA and GAWP collected data in the field. JALB, ZISH and DL retrieved data from the literature and wrote the text. JALB, DL and GAWP analyzed the information.

Appendix 2: Voucher Specimens Recorded and Deposited in Scientific Collections

Acronyms: **CAS** = California Academy of Sciences, San Francisco; **CNAR** = Colección Nacional de Anfibios y Reptiles, Instituto de Biología, Universidad Nacional Autónoma de México (UNAM), Mexico City; **KU** = University of Kansas Biodiversity Institute, Lawrence, Kansas; **SDNHM** = San Diego Natural History Museum, Balboa Park, San Diego, California; **TCWC** = Texas A&M University, Texas Cooperative Wildlife Collection, College Station, Texas; **UANL** = Universidad Autónoma de Nuevo León, Facultad de Ciencias Biológicas, Departamento de Zoología de Vertebrados, San Nicolás de los Garza; **UAZ** = University of Arizona, Museum of Natural History, Tucson, Arizona; **UTADC** = University of Texas at Arlington Digital Collection; **UTEP** = University of Texas at El Paso.

Incilius marmoreus: UTEP H-5862–64. *Incilius occidentalis*: UAZ 38216–23. *Craugastor augusti*: UTEP H-7430. *C. occidentalis*: UTEP H-6960. *C. pygmaeus*: UTADC 8687. *C. vocalis*: KU 63336–37, UTEP H-6534–38. *Eleutherodactylus pallidus*: UANL 8382. *Dryophytes arenicolor*: UANL 8383. *Smilisca baudinii*: UTEP H-8446. *Tlalocohyla smithii*: KU 63366. *Agalychnis dacnicolor*: UANL 8384. *Leptodactylus melanonotus*: CNAR 5789, UANL-8385. *Hypopachus variolosus*: UANL 8386. *Lithobates forreri*: CNAR 5804. *L. magna-ocularis*: UANL 8394. *L. pustulosus*: UTEP H-6961–66, H-7580. *Ambystoma rosaceum*: UANL 8387. *Norops nebulosus*: UTEP H-7431, UANL 8388. *Hemidactylus frenatus*: UANL 8389. *Heloderma horridum*: UTEP H-4033. *Ctenosaura pectinata*: SDNHM 55291, UANL 8391. *Sceloporus albiventris*: UANL 8392. *S. clarkii*: UANL 8393. *S. nelsoni*: UTEP H-6530, H-6968, UANL 8395. *S. utiformis*: CAS 135361, UTEP H-6967. *Urosaurus bicarinatus*: CNAR 5787, UANL 8396. *Phyllodactylus lanei*: KU 63370, UANL 8397. *P. tuberculatus*: UTEP H-4906. *Aspidoscelis costata*: CNAR 5832, UTEP H-5316. *Boa sigma*: UANL 8398. *Lampropeltis polyzona*: UANL 8399. *Leptophis diplotropis*: UANL 8400. *Masticophis mentovarius*: UANL 8401. *Mastigodryas melanolomus*: UTEP H-9042. *Oxybelis aeneus*: UANL 8402. *Pseudoficimia frontalis*: UANL 8403. *Tantilla yaquia*: UANL 8404. *Trimorphodon paucimaculatus*: UANL 8405. *Leptodeira maculata*: UTEP H-7434. *Micrurus distans*: UANL 8406. *Storeria storerioides*: UAZ 26389. *Agkistrodon bilineatus*: UANL 8407. *Crotalus basiliscus*: UANL 8408. *C. lepidus*: TCWC 33358–59. *Trachemys ornata*: UANL 8409. *Kinosternon integrum*: UANL 8410.

Drought and Opportunistic Rain Harvesting by *Crotalus atrox* and *Trimorphodon lambda*

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This herper realizes that the herping can't keep getting better every year. The art of herping is a lot like the stock market. It can't keep going up and up—it has to crash at some point. It appears that this is the year of the crash. - RAR, 27 August 2002

This author must confess that he immediately mentally condemns any person of whatever caliber or station in life who thinks that climate change is a myth. They may not be stupid, but they *are* ignorant. The fact is, they don't go outside enough to see with their own eyes what is developing in their own region—*wherever* that region may be. When I speak of the effects of climate change in Southern Arizona, I can't offer any of the drama of glaciers melting, polar bears drowning, oceans rising, hurricanes increasing in numbers and magnitude, tornadoes ripping the nation asunder, or the like. What I *can* offer is drought, and plenty of it. In 12 of the 17 years from 2000 to 2016, rainfall totals as documented by NOAA have given Tucson a less-than-average yield. There are streaks of drought, measured in lack of rain for ever-increasing numbers of days buried in these 12 below-average rain years. *Seven* of these drought spells occurred from the year 2000 through 2016, and each broke previous records for days without rain. Our weather records date back to 1895, yet seven times in the past 17 years, over the course of 124 years, there have been record-breaking stretches of drought. I will not know until this year is behind us exactly how bad 2019 has been. I am already calling it the worst year ever, meaning: probably the hottest ever (and in Tucson, when it is hot, it is *really* hot), and on my patches of ground to the north of Tucson, the driest ever. In 2002, I constantly noted in my journal “how can *anything* survive this?” I ask the same question now. One last detail of this 17-year period is in order. The average rainfall for the entire period has been 9.8 inches per year. The average going back to 1895 is hovering at ~11.6 inches annually, and falling slowly but steadily as each yearly account enters the books. I have seen ever-increasing drops in numbers of snakes and common lizards during this time. That 1.8 inches of average yearly rainfall that we are lacking can make the difference between feast or famine with the herps under watch. Yeah, polar bears are dying as a result of climate change, but so are the herps!

The drought from fall/winter 2005 to spring 2006 was rough. But I was out herping the very day that it finally broke. That day was 11 March 2006. After 175 days of zero measurable rain at the Suizo Mountain Study plot, a glance at the radar on this 11 March date indicated that clouds were beginning to gather there. My reaction was immediate. I quickly gathered everything I needed, and dashed out the door. I went right into the teeth of the coldest and most fearsome storm I have ever faced *anywhere*. (This herper is a big fan of the saying “The idiot doesn't have sense enough to come in out of the rain.”) On this day, for once, this idiot also did *not* have sense enough to come in out of the rain. I rushed into it, and met it head on! I arrived at 1458 hours, and left at 1645 hours. During that roughly 1.75 hours of herping, I faced a raging storm with temps as low as 3 °C, wind

speeds up to 50 mph, and stinging sleet that nearly bead-blasted the skin off my exposed face. When I got home, as soon as I warmed up enough to do so, I sat down and recorded a blow by blow, chronological and orderly accounting of the day. It took the better part of three pages to do so, and these notes remain the most solid and detailed testimony to what happened in one single day in all of my record-keeping through the 30-year time period under discussion. These notes will appear at the end of this column as Figure 3.

At this point in time, nobody in all of Arizona had ever done what I was about to do. A few others came with me for some future, similar events—stalwarts all! But 11 March 2006 was the first. I went into the storm with but one question to answer: “Would ectothermic creatures like rattlesnakes rise above the limitations of being cold-blooded to get an opportunistic drink of water?” The answer at the end of it all was an emphatic “hell yes!” The temptation is great to just quote, word for word, what my journal has to say. But we instead resort to brevity, with the hope that the reader will read, word for word, the images of those field notes provided with this column.

When I arrived at the plot at 1458 hours, the ambient air temp was 8.5 °C (40.5 °F), with 100% clouds, estimated 90% humidity, and 5–40 mph gusting winds. The rain had just started, with an estimated 0.1 inches accumulating before I began my ordeal. Just before I stepped out of my truck, I made the notation in my journal that always indicates when I am alone. I use the word “Solo.” Just after this notation, I wrote “(Who else would be here?)” I left all tracking gear, datasheets, my herp journal, and digital camera inside the truck when I stepped out into the raging storm.

Unfortunately, while doing a good deed for herpetology the night before, I had accidentally left my heaviest, most rain-repellent jacket (a Chicago Bears jacket, a gift from Ruth Repp, my mother) at an office in the Arizona Game and Fish Department. Why did I do that? While helping an employee to develop some inexpensive-to-make yet solidly-constructed sign frames, both the artist and I were kicked out of her office so that she could go take a nap. “I don't want to be rude (she was), but I need to go home and take a nap!” Yeah, we had just spent two hours of our own time there, and then the clock struck five! Good idea, kick two guys out of your office who sometimes each earned 500 bucks an hour for their advice, because you need a nap? You dissed us as well as your own project for an *effing* nap? I hope that nap was worth it—because lady, you suck! And I was kicked out so fast that my jacket was left behind. This stopped me from completing my *real* mission on 11 March. I was going to include what several tortoises and Gila Monsters were doing on this, the day the drought broke. They

were all on the windward side of this hill, and the cold defeated me. My Bears jacket would have allowed me to go on. As it was, I was layered with the warmest, driest clothing I could find, and that Bears jacket would have gone nicely right over top. In short—no good deed ever goes unpunished!

I am going to recall the events that happened as if they are happening in the “now” tense of writing. Thirteen minutes into the storm, I arrive at *atrox* den #1, also known as AD1. AD1 has three *atrox* out of the den, and on the apron just outside of it. Their jowls are widening and narrowing as their tongues are lapping the cold moisture droplets off their flanks. Each tongue lap, and corresponding pulsating jowl motion, is taking fully two seconds to occur. They are drinking, but doing so in very slow motion. My question is already answered—13 minutes into the hike! In addition to the *atrox*, a large adult Sonoran Lyresnake (*Trimorphodon lambda*) is viewed rapidly lapping water droplets off the rim of the top of the narrow, one-meter-long horizontal crevice. Its body is inside the crevice itself, where the temperature is likely ~16°C (61°F). (The lyresnake is likely *much* warmer than the more exposed *atrox*.) Only 10% of the head and anterior portion of this snake are visible, the rest is inside the den. I see belly scales, chin scales, and an ~20-mm-wide head drinking off the top rim of the crevice. The lyresnake spies me shortly after I notice it, and dives out of sight. Damn—I miss that jacket. My camera fits snug and dry inside its pockets, but NOPE! History is passing before my eyes, but no jacket and no camera! I move on, taking the name of that *wench* of a bored bureaucrat in vain for the remainder of round one of this hike. She kicks me out of her office for a nap? A pox be upon her!

At 1547 hours, I arrive at “Hobby Den.” This is a tight-running crevice that angles about 1.5 meters in length down a slab of a massive gneiss boulder. Gordon Schuett and I named this crack “Hobby Den” because we agreed to just watch it, and *not* disturb any of its occupants. (This agreement lasted about one year. By March 2007, we hammered it with everything we had.) An adult female *atrox* is viewed with roughly 50 cm of her body stretched out across the boulder, lapping water that is flowing down the same. The remaining third of her body is tucked inside the crevice. Another photo op is lost, and more cussing is well aimed in the direction of nine-to-five bureaucrats. The cussing reaches epic proportions when I look down a narrow, known lyresnake crevice. (This one is “SMLYRE#7,” a crack that first came my way in February of 2002. It continues to produce lyresnakes to this very day.) I look downward into this crevice with the beam of a flashlight to help me see what is going on there. At precisely 1600 hours, I see a young adult lyresnake drinking water that is running down the inner wall of the crevice. There is actually water accumulating on its flanks and the side of its head, but it chooses instead to drink off the wall of the crevice (see sketch in Figure 1). By this time, the rain has increased to a raging downpour, and is mixed with sleet and fierce winds. I head up to the saddle of Iron Mine Hill to go over top and check on some known tortoises and Gila Monsters. Here the 50 mph wind gusts force me back to the leeward side of the mountain. By now, my tirades are highly audible, but rather redundant. There are only so many cusswords that can be directed at *any* person, and any variety in my highly-honed verbal

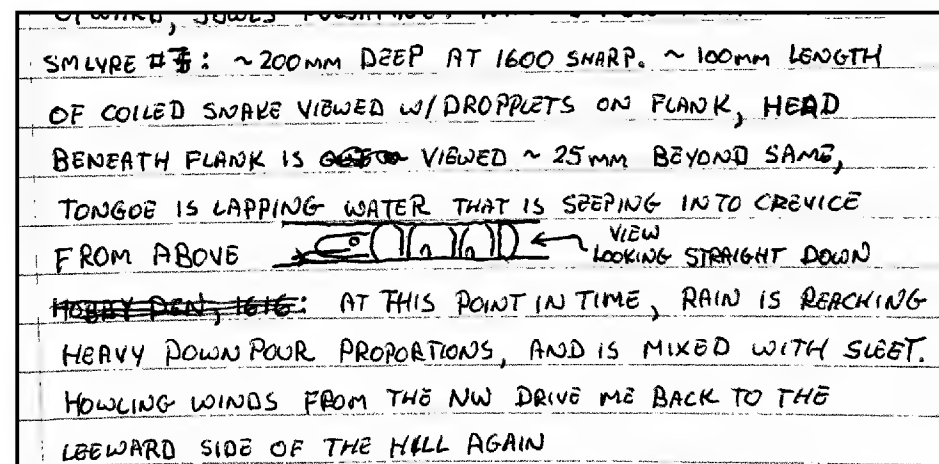


Figure 1. This image is an enlarged excerpt from the author’s field notes of 11 March 2006. The sketch and surrounding text describe a Sonoran Lyresnake (*Trimorphodon lambda*) rain-harvesting water flowing down the inside of a vertical crevice wall. This enlarged view reveals something that has likely been otherwise undocumented in the wild. There were two lyresnakes observed rain-harvesting this day, but no photographs of the behavior exist. This sketch is all that we have to show. Image by Roger A. Repp

assault skills has been used up. I blow by SMLYRE#7 without a glance. I note that the Hobby Den female *atrox* is now inside her crevice, drinking droplets of water that are flowing downward off the top of her crevice home. A quick look at AD1 reveals there are now four *atrox* drinking! I dash for my truck, stuff my camera in plastic bag for protection, and head back to AD1. I fire off several images of what is going on, the results of which can be seen in Figure 2. After that it was time to go home.

And now we break in the action in order to allow some new thoughts, resplendent with the bitching that is my trademark. In his book *The Dead Zone*, Stephen King records a fictional account of photographers who have gathered around a very sinister presidential candidate. They are discussing what makes a photograph memorable. I expect that Mr. King was once part of such a discussion, and that is where he got this conversation. It is not always the quality of the photo, but the timing. In *The Dead Zone*, one of the photographers gets a photo of the sinister presidential candidate using a child as a shield against a sniper. Yup! That would be a money shot all right! Two *real* money shots that come to mind for me are both from the Vietnam era.



Figure 2. Four Western Diamond-backed Rattlesnakes (*Crotalus atrox*) harvesting (drinking) rainwater off their flanks, as well as a vertical boulder surface. Air temperature was 3°C (37.4°F), 100% clouds, 100% humidity and howling winds. The rain was mixed with sleet at the time of the photo. Image by the author, 11 March 2006.

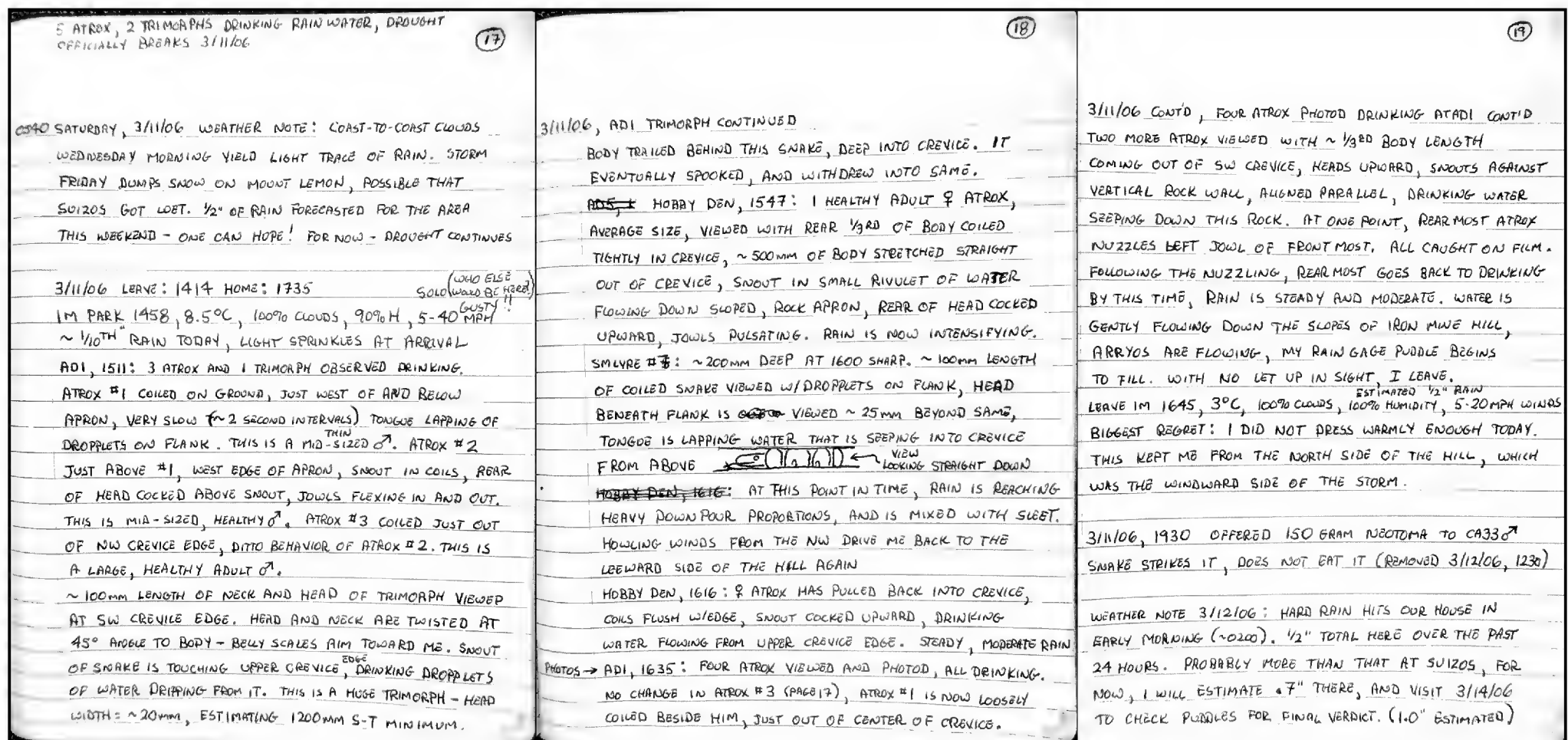


Figure 3. These pages are the notations of a very conscientious field herpetologist who is recounting an incredible series of events. Also included are some words that indicate (first page) that the author is very attuned to the vicious drought of 2005–2006. The bottom of the third page indicates that the drought is over, and rains are beginning to arrive. There are also words in the text of this column that indicate that the rain came on strong in 2006, and the herps who survived this drought responded favorably. The author hopes the reader will read these notations, (as well as the text), word for word, and judge for themselves whether the words are worth their effort.

Any reader who was seven years old or older will remember these photos as soon as they come off my fingertips. The first is of a naked, 12-year-old girl running with arms splayed wide. Her mouth is downturned in a wide-open scream of pain and terror. She has just suffered the effects of a napalm bomb, and has burns on a large portion of her body. The second is of a man getting shot through the temple at point blank range with a pistol. The photo is so righteously timed that one sees the bullet starting to emerge from the other side of the victim's head. It is awful, yet difficult to turn away from.

And so Fat, Dumb and Happy here is standing in a driving rain and sleet storm, risking my camera to take photos into the rather unremarkable backdrop of a crevice den. The camera is exposed to the elements a total of 20 or so seconds, and large drops of water on the lens with the last few photos demonstrates the wet work involved. I enter the field knowing my camera, albeit humble, is good enough to get a money shot that may transpire on a field outing. Four rattlesnakes, clearly photographed drinking water, under impossible conditions, ought to be worth more than it is/was. I can promise you that any of the best herptographers would not *dare* expose their cameras to the deluge that I faced, let alone get an image of what went down in it. In short, there is nobody else in the world who would dare what I did this day. The result is not artful, it only records fact—a fact that nobody else in all of Arizona had published at the time. That fact is hell yeah, in times of drought, herps *will* rise above the limitations of being ectothermic to get a much needed drink of water.

Another of these rain events happened in a different location one week later. What happened that day has already been relayed to you. See the July 2015 issue of the *CHS Bulletin*. Shortly after both rain drinking experiences happened, Dr.

Gordon Schuett and I decided to do a peer review article about both events. We selected *Southwestern Naturalist* to do this article. I thought my picture belonged on the front of *National Geographic*, let alone any lesser pub. Said lesser pub did not agree, and turned down even running a small black-and-white image of it. On top of that, for want of any similar observations, we completely dropped the notion of stating that two lyresnakes were also viewed drinking on this day. As Gordon aptly put it “This opens up another can of worms.” He was correct with his stated assumption. While somebody, somewhere, has probably seen a lyresnake drinking, they most likely have yet to publish it. This column may be a first.

I am pleased to present the black-and-white image in this publication. It is all gray, bleak, wet, cold and sloppy—just like the weather conditions on that day. With all the wonderful images of herpetologically historic events to occur through the years, this one is the best behavioral photograph that has ever come from any camera I owned. It required a heroic effort to get this image, and even greater heroics by the subjects who were doing everything in their power to survive the drought. I'm happy to report that after this incident, the “rain train” was merciful and generous for the remainder of the year. We saw all manner of herpetological natural history events explode by the summer of 2006. Them that survived the drought moved on, with individual style and group performances, into the greener pasture that soon followed. But that is another story.

This here is Roger Repp, signing off from Southern Arizona, where the turtles are strong, the snakes are handsome, and the lizards are all above average.

What You Missed at the September Meeting: Ann-Elizabeth Nash

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Ann-Elizabeth Nash started her presentation with a quote. “One day can bend your life.” Over 20 years ago when she was a program administrator for the National Center for Atmospheric Research a colleague asked her to babysit his green iguana. Ann-Elizabeth, who at that time knew little about reptiles, said naively, “Sure.” And her life bent. She found the iguana fascinating and was “utterly hooked.” She soon began adopting other iguanas, which led to creating the Colorado Reptile Humane Society (CoRHS), a “small but mighty organization” in 1998. She is the executive director of that organization and lives with many reptiles and some mammals, including a dog and two rescued donkeys. And her husband, whom she described as “the other mammal thing” sharing her adventure.

The stated goal of the CoRHS is “to improve the lives of reptiles and amphibians in captivity and in the wild through education and action.” CoRHS provides shelter and proper husbandry while securing permanent homes for the animals, provides public education, participates in conservation efforts, and engages in rehabilitation and release of native species. Through a combination of idealism and pragmatism, Ann-Elizabeth has accomplished those goals and brought real change to animals’ lives, peoples’ views, and bureaucratic rules. The first thing that impressed me about her was her love for these animals and the way she advocated for them. She is not willing to accept that these are animals in some way less important than dogs or cats and operates her shelter on that principle. In making the changes that she has, she demonstrates that love of the animals is not enough, but one also needs a firm grasp of the realities dealing with the many organizations and people that a shelter must work with.

Ann-Elizabeth is a regular speaker at the Colorado Animal Control and Care Conference, where she has impressed the officers that there are reptiles and amphibians that need their services. She has convinced at least some local animal shelters that they need to care for these animals with the same attention they give to dogs and cats. The CoRHS holds behavior and learning workshops with the veterinary school, exposing the students to animals they may never wish to treat but should recognize as worthy of care. Repeated education of these and other organizations has furthered the goals of the CoRHS and given it more visibility and credibility in the state.

Ann-Elizabeth has worked to improve Colorado’s laws and regulations dealing with reptiles. She worked to change reporting forms for shelters to include animals besides dog and cats and birds. She worked to require reptile breeders to be licensed in the state, including requirements for housing, and then convinced the state to supply the five state inspectors with temp guns and UVB meters so they had the means to check compliance.

She has convinced other shelters that they cannot ignore these animals. They need to have at least the minimum care requirements until they can be transferred to her facility and the CoRHS will explain what those are. She charges some shelters

for accepting their transfers. The CoRHS has convinced shelters that they should not simply dump reptiles and amphibians on pet stores or breeders. Some shelters are now receiving and adopting out the animals without transferring them. She has assisted in welfare seizures, some very large and very disturbing, and has acted as an expert witness in cases of abuse.

Throughout her talk, Ann-Elizabeth talked about the importance of working with people in a mostly non-judgmental way. She knows that many people simply don’t know about reptiles or amphibians, so she tries to engage people in the proper care or disposition of their animals. She warns people away from hard to care for pets, and helps people discover cheaper or easier ways to properly care for their animals rather than give them up for adoption, but the CoRHS is an open door shelter that will accept any animal if space is available. Ann-Elizabeth interacts with the public over the phone to help them with problems. She told the story of a Skype conversation with some nervous souls wondering how to free a bullsnake from bird netting. After some discussion the man and boy donned gloves, cut netting, and sent her a photo of the boy proudly holding the about-to-be-released snake. Success comes in working with people.

She does not apply the non-judgmental rule to cases of abuse. We saw a photo of a slightly larger than four-foot alligator that had been kept in an aquarium maybe six inches longer than it was. She accepted the animal and eventually placed it in a Florida sanctuary. And she accepted animals from the horrendous 2009 U.S. Global Exotics animal cruelty case. She often has trouble convincing prosecutors that animal cruelty cases involving reptiles can be successfully tried.

She then gave us a short overview of the research she has done working toward her doctorate. She developed an interest in studying iguanas while volunteering with the Blue Iguana Recovery Program in the Cayman Islands. Deciding that behavior was what fascinated her, she chose the common spiny tailed iguana (*Ctenosaura similis*) to study. The lizard is social, common, and easy to find in Costa Rica, a country where it is relatively easy to conduct a study. She compared them to squirrels in that they are very accustomed to people but not approachable and freely use our stuff. She studied the animals’ interactions with each other, doing personality assays and building graphs of their contacts. She defends her doctoral thesis this October. I have no doubt she will do well.

The CoRHS has accomplished much more in its over 20-year existence. Ann-Elizabeth sees a problem and works to correct it. That approach has moved her to change laws, attitudes, and procedures toward all reptile and amphibians, wild or captive. Because of her efforts, she has made “a real difference to others and yourself.” My favorite quote, and something many of us who are fascinated by these animals should heed, is her philosophy when dealing with other organizations, particularly other shelters. “If you do X, Y, Z for a dog, or a cat, or a bird, you ought to pay a similar level of attention to reptiles and amphibians.”

Herpetology 2019

In this column the editorial staff presents short abstracts of herpetological articles we have found of interest. This is not an attempt to summarize all of the research papers being published; it is an attempt to increase the reader's awareness of what herpetologists have been doing and publishing. The editor assumes full responsibility for any errors or misleading statements.

HOTSPOT OF TADPOLE ABNORMALITY IN SOUTH-WEST FLORIDA

S. P. Anzaldúa and J. Goldberg [2019, The Herpetological Journal 29(2):115-124] report that a high concentration of Cuban treefrog (*Osteopilus septentrionalis*) tadpoles displaying morphological abnormalities was discovered in an untreated swimming pool in Bonita Springs, Florida. This find initiated a 4-year survey (2012–2015) of surrounding roadside drainage ditches that had been treated with insecticide for mosquito control. The study was extended to the populations of Ave Maria, Florida, and Everglades National Park. The core data set of 36,550 tadpoles from the swimming pool and ditches contained 25,136 abnormal tadpoles, an abnormality average of 68.8%, well above the 5% minimum definition for a hotspot. The frogs from Ave Maria and the Everglades National park were 0% abnormal. The type of tadpole abnormality differed between the suburban treated roadside drainage ditches versus the untreated swimming pool, although the same abnormalities were found in both the suburban treated and untreated water. In the untreated swimming pool, 70.1% of tadpoles displayed abnormalities such as bent tails, abnormal limbs, and disfigured or absent mouthparts. Larvae in the untreated swimming pool metamorphosed en masse despite abnormalities. The high frequency of abnormal metamorph abnormalities found were: kyphosis, scoliosis, microcephaly, and forelimb abnormalities. In the treated roadside drainage ditches, Gosner stage 16–25 tadpoles could not undergo metamorphosis and experienced

mass mortality. The abnormalities found at Gosner stage 16 of the embryo were in the head and body. Tadpoles at Gosner stages 19–25 failed to develop gills, were bloated, had growth retardation, and mouthpart abnormalities. The older Gosner stage 25–41 tadpole populations in the ditches showed bloating, lumps, emaciation, and growth retardation. A brief synopsis of *O. septentrionalis* treefrog biology is also given, including breeding congregations, average 8 hour time to hatching, and 19 days metamorphosis.

HORMONES AND MATERNAL CARE

A. J. Anton et al. [2018, Herpetological Journal 28(3):123-126] note that maternal care behavior is rare in reptiles and the hormonal control of this behavior is less well known than in other vertebrates. The steroid hormone, corticosterone, suppresses maternal behavior in avian species. The authors investigated whether corticosterone similarly affects maternal behavior of a lizard. They artificially elevated corticosterone in female prairie skinks, *Plestiodon septentrionalis*, during egg brooding and assessed effects on maternal behavior (versus females receiving a vehicle control). The application of exogenous corticosterone significantly decreased the amount of time that females spent in contact with their eggs. These results suggest that, as in birds, corticosterone acts to reduce maternal behaviors in reptiles. This provides important insight into the hormonal control of, and effects of stress on, parental care in reptiles.

Minutes of the CHS Board Meeting, September 13, 2019

Rich Crowley called the meeting to order at 8:00 P.M. Board members John Archer, Rich Crowley, Mike Dloogatch, Gail Oomens and Mike Scott were in attendance. A quorum was not present. Minutes of the August 16 board meeting were read.

Officers' Reports

Treasurer: John Archer presented the financial report for the month of August.

Membership Secretary: Mike Dloogatch read the list of expiring memberships.

Sergeant-at-arms: Mike Scott reported 42 people in attendance at the July general meeting.

Committee Reports

Shows: Gail Oomens quickly read through the list of upcoming shows. She requested help for September 28 and October 6–7 due to a number of simultaneous events those days.

ReptileFest: Frank Sladek reported that Northeastern Illinois

University has another event booked for April 4–5. He will try to schedule 'Fest for after Easter. Possible sponsors for our event were discussed.

Junior Herpers: Frank Sladek reported on the September field trip to Cranberry Slough Nature Preserve then to the Little Red Schoolhouse. The trip was just awesome; all the kids were able to find their own frogs and salamanders; just an all-around great day!

Nomining committee: The committee is still looking for candidates for a couple of positions.

New Business

John Archer reported that Brookfield Zoo will be hosting the annual meeting of the Association of Zoos & Aquariums Herp Taxon Advisory Group (Herp TAG) next spring. Andy Snyder has asked if the CHS would be able to sponsor some of this event.

The meeting adjourned at 9:52 P.M.

Respectfully submitted by recording secretary Gail Oomens

Advertisements

For sale: **highest quality frozen rodents.** I have been raising rodents for over 30 years and can supply you with the highest quality mice available in the U.S. These are always exceptionally clean and healthy with no urine odor or mixed in bedding. I feed these to my own reptile collection exclusively and so make sure they are the best available. All rodents are produced from my personal breeding colony and are fed exceptional high protein, low fat rodent diets; no dog food is ever used. Additionally, all mice are flash frozen and are separate in the bag, not frozen together. I also have ultra low shipping prices to most areas of the U.S. and can beat others shipping prices considerably. I specialize in the smaller mice sizes and currently have the following four sizes available: Small pink mice (1 day old—1 gm) , \$25 /100; Large pink mice (4 to 5 days old—2 to 3 gm), \$27.50 /100; Small fuzzy mice (7 to 8 days old—5 to 6 gm), \$30/100; Large fuzzy mice / hoppers (10 to 12 days old—8 to 10 gm), \$35/100 Contact Kelly Haller at 785-224-7291 or by e-mail at kelhal56@hotmail.com

Herp tours: **Costa Rica herping adventures.** Join a small group of fellow herpers for 7 herp-filled days. We find all types of herps, mammals, birds and insects, but our target is snakes. We average 52 per trip, and this is our 10th year doing it. If you would like to enjoy finding herps in the wild and sleep in a bed at night with air-conditioning, hot water and only unpack your suitcase once, instead of daily, then this is the place to do it. Go to our web-site <<http://hiss-n-things.com>> and read the highlights of our trips. Read the statistics of each trip and visit the link showing photos of the 40 different species we have found along the way. E-mail at jim.kavney@gmail.com or call Jim Kavney, 305-664-2881.

Free to a good home: Past issues of the *Bulletin of the Chicago Herpetological Society*, 2012–present. Pick them up at your convenience; I am just off the Eisenhower (I-290) in Oak Park. Call Rob Streit at 708-383-6830.

Line ads in this publication are run free for CHS members — \$2 per line for nonmembers. Any ad may be refused at the discretion of the Editor. Submit ads to mdloogatch@chicagoherp.org.

NEW CHS MEMBERS THIS MONTH

Jory Bell
Paige Davies
Shea Downer
John Gutierrez
Rob Hermann
Jesi Merrick
A. E. Nash

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News and Announcements

2020 CHS HERPETOLOGICAL GRANTS PROGRAM

The mission of the Chicago Herpetological Society is education, conservation and the advancement of herpetology. To further this mission, the CHS provides grants of up to \$1,000 in the following categories:

1. Illinois Herpetology
2. Graduate Student Research in Herpetology
3. Undergraduate Research in Herpetology
4. Conservation
5. Captive Management, Husbandry and Propagation

The number of grants awarded in each category will depend on the grant applications received; it is possible that not all categories will receive awards and some categories may receive more than one award. The Grants Committee reserves the right to reassign the category under which a given proposal is submitted.

To qualify for a grant, the applicant must be a member of the Chicago Herpetological Society as of December 31, 2019. In accepting a grant, the recipient agrees to acknowledge the Chicago Herpetological Society in any publications or public presentations of research funded by this grant. Further, the recipient agrees to abide by all state and federal laws.

Recipients must submit a short report of their research findings to the CHS within 6 months of their anticipated completion date. The report should be written for a general audience and be suitable for publication in the CHS *Bulletin* or on the CHS webpage. This requirement may be waived if results will be published in a peer-reviewed journal within a year. Recipients may be invited to present a program at a CHS general meeting.

Applications must include the following:

1. Project title
2. Applicant's name, address, phone and email
3. Submission category
4. Introduction—Provide background for the proposed work. Include a clear statement of the objectives of the proposed work.
5. Materials and methods—Describe the study site and the materials and methods (in non-technical terms) that will be used to accomplish the objectives of the proposed research. Attach plans, diagrams and maps as necessary. Indicate whether you have an approved Animal Care (IACUC) protocol covering the proposed methods or whether you will be submitting such a protocol.
6. Applicability and broader implications—How does this work apply to conservation, education and the advancement of herpetology?
7. Budget—Indicate the budget for the entire project and make clear what portion the CHS grant money would fund.
8. Anticipated completion date for the research
9. Applicant curriculum vitae
10. Letters of support—Student applicants must include a letter of support from a faculty advisor. For non-academic individual and institutional applicants, letters of support from collaborating partners or institutions are strongly encouraged. Letter(s) of support may be emailed and should include an address and phone number at which the writer can be contacted. Letter(s) of support may also be sent by postal mail.

Proposals should be submitted as email attachments. Attachments should include the applicant's name in the file name. Proposal text should not exceed five double-spaced pages (excluding literature cited, applicant's CV, and letters of support) and should be typed using a common font (e.g., Arial, Times, Courier) no smaller than 10 pt. Applications must be received by December 31, 2019, and awards will be announced by February 15, 2020.

Proposals or questions should be emailed to grants@chicagoherp.org

UPCOMING MEETINGS

The next meeting of the Chicago Herpetological Society will be held at 7:30 P.M., Wednesday, October 30, at the Peggy Notebaert Nature Museum, Cannon Drive and Fullerton Parkway, in Chicago. **John Vanek**, a graduate student at Northern Illinois University, will speak about “Urban Ecology and the Herpetofauna of Lake County, Illinois.”

Please note that the November monthly meeting has been rescheduled from the usual last-Wednesday-of-the-month to Wednesday, November 20. The November 20 meeting will include the annual election of officers and members-at-large of the CHS Board of Directors. There will also be a speaker as usual, but none has been confirmed as of this writing.

The regular monthly meetings of the Chicago Herpetological Society take place at Chicago’s newest museum—the **Peggy Notebaert Nature Museum**. This beautiful building is at Fullerton Parkway and Cannon Drive, directly across Fullerton from the Lincoln Park Zoo. Meetings are held the last Wednesday of each month, from 7:30 P.M. through 9:30 P.M. Parking is free on Cannon Drive. A plethora of CTA buses stop nearby.

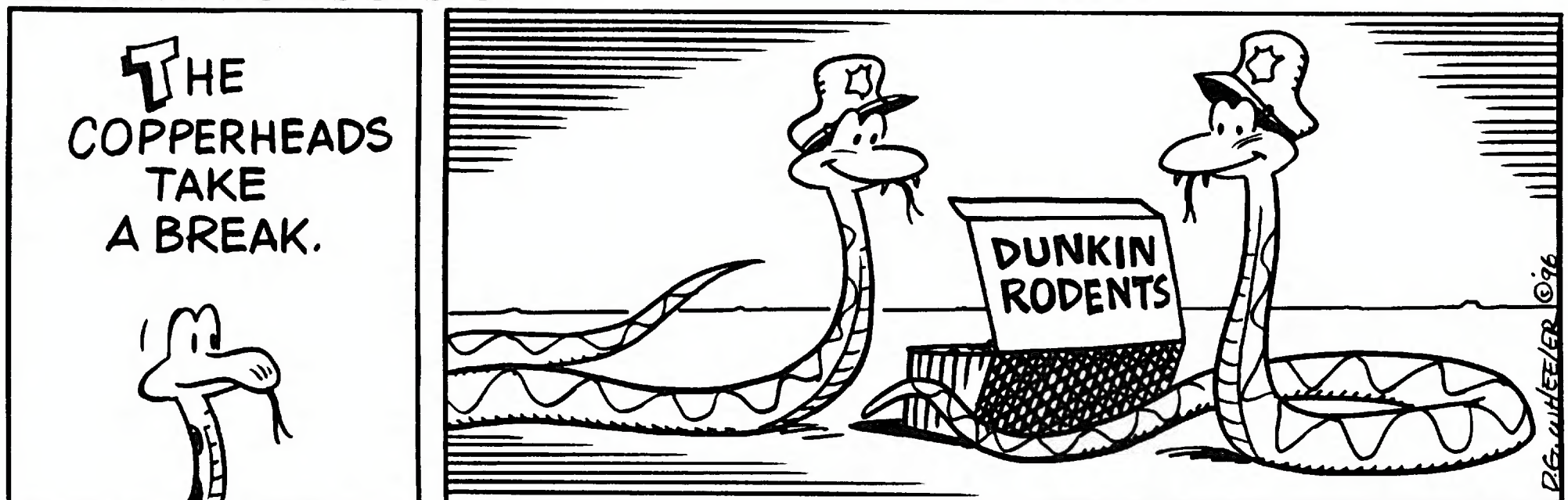
Board of Directors Meeting

Are you interested in how the decisions are made that determine how the Chicago Herpetological Society runs? And would you like to have input into those decisions? The next board meeting, will take place at 7:30 P.M., November 15, 2019, at Papa Passero’s Pizzeria, 6326 S. Cass Ave., Westmont. If you think you might like to attend, please email rcrowley@chicagoherp.org.

The Chicago Turtle Club

The monthly meetings of the Chicago Turtle Club are informal; questions, children and animals are welcome. Meetings normally take place at the North Park Village Nature Center, 5801 N. Pulaski, in Chicago. Parking is free. For more info visit the group’s Facebook page.

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